



M-Tool

The Mental Model Mapping Tool

M-Tool Manual

Web-based version

Welcome to M-Tool!

This manual lays out the key features and information on how to use M-Tool and tailor it to your needs.

What is M-Tool?

M-Tool is the Mental Model Mapping Tool developed by Dr. Karlijn van den Broek, Dr. Helen Fisher and Dr. Sina Klein at University of Heidelberg, and Joseph Luomba, researcher at Tanzania Fisheries Research Institute. It is designed to capture mental models, internal representations that describe an external environment. The external environment can be any type of system that consists of factors and causal links between those factors. M-Tool allows respondents to create models of a particular system by organizing relevant factors and linking them. M-Tool is available as a free app that can be downloaded in the google and apple appstores, and as a web-based version that can be used in a browser. The latter version also includes a bar chart drawing feature, in which participants display their views on their relation between two variables, for example the fluctuation of a particular resource over time. This manual lays out how to use the web-based version.

The left example below illustrates a mental model of the drivers of the changes of the Nile perch stock. It shows how this fisher believes that the strongest influence on the fish stock is fishing in breeding grounds (thick arrow), which is influenced by climate change, which in turn also has a direct influence on the Nile perch stock, as well as the use of illegal gear. The example on the right illustrates a more complex mental model captured with M-Tool. For more examples of applications of M-Tool in research projects see www.m-tool.org.

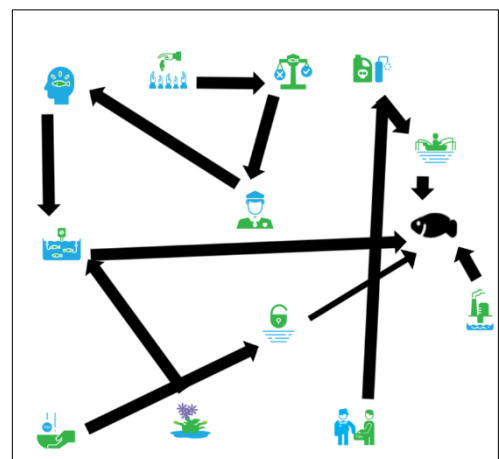
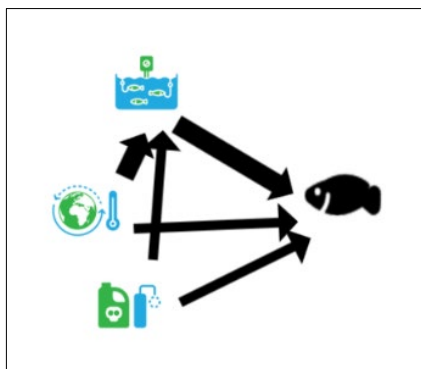


Figure 1. Examples of a simple (left) and complex (right) mental model created with M-Tool. The figure shows mental models of Tanzanian fishermen of the drivers that influence the target variable, the Nile perch stock.



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Why use M-Tool?

- A standardized tool – for comparing mental models
- Suitable for large sample sizes
- Does not require respondents' literacy
- Available online as well as offline
- Can be tailored to map perceptions of any system or phenomenon

In contrast to other mental model elicitation methods, M-Tool uses a fully computerized approach that allows rapid collection of large samples. M-Tool's standardized approach ensures respondents will use the same system variables with which they draw their mental model. M-Tool hence gives you the unique benefit of comparing the mental models across and within (groups of) respondents. M-Tool is the first mental modelling tool to allow users to uncover differences in mental models which may keep stakeholder groups from addressing challenges jointly and effectively (van den Broek, 2018).

Because you can populate the tool yourself, mental models of any kind of system can be captured. Some examples of how M-Tool can be used:

- Comparing mental models between groups of respondents (e.g. different types of stakeholders, experts vs. the general public, across cultures, communities from different geographical areas, comparing children's mental models)
- Assess changes in mental models over time, to investigate the stability of mental models or the impact of an intervention on the respondents' mental model.
- To start a conversation between stakeholders on the functioning of a system and how to address challenges within the system.
- Compare perceptions with the true state of a system.
- Investigate the relation between (differences in) individual mental models and collective mental models composed in a group.

Compared to interviewing techniques, M-Tool allows respondents to draw more complex mental models, thereby giving more detailed insights into their understanding of a system (van den Broek et al., forthcoming). Moreover, by including icons to display the relevant system variables, M-Tool can be used without relying on respondents' literacy. This tool has been validated with rural fishing communities, demonstrating both convergent and external validity (van den Broek et al. forthcoming).

Tailoring M-Tool to your needs

With M-Tool you can include the system variables that are relevant for your project. These variables can be generated by your mental model target group, for example through short interviews or surveys (e.g. What are the elements of [a system], What factors do you think drive..., what are the consequences of ...).

Alternatively, you may be interested to see if your target group would make certain connections based on an existing set of variables. These factors may be informed by pre-existing knowledge of a system, i.e. to assess if you target group can draw up the 'correct' dynamics between factors. Furthermore, you can replace the audio instructions and videos with your own files to adapt the instructions to your needs, or to translate it to the relevant language.

M-TOOL can be set up in various ways:



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1. The drivers and consequences of a target variable (i.e. the fixed factor: the fish in Fig. 1 or “Y” in the app) can be mapped separately (by placing the target variable on the left for mapping screen 1 and on the right for mapping screen 2). This eases the cognitive demands on the respondents.
2. The drivers and consequences of a target variable can be mapped at once, so a respondent can show how the drivers and consequences can influence each other (e.g. by placing the target variable in the middle).
3. The tool can be set up without a target variable/fixed factor, so the respondent maps the entire system.

This means that you can map any aspects of any system (e.g. network of actors, dynamics of an ecosystem etc.).

How to use M-Tool?

To get started using M-Tool, follow these simple steps:

1. Generate a list of relevant variables for the respective system.
2. Turn these factors, as well as your ‘target variable’ (if applicable) into images (e.g. through a freelance graphic designer platform like [Fiverr](#) or use images with text).
3. Create a video that explains the meaning of each image (e.g. [with PowerPoint](#))
4. Extract the audio files from this video for each image (e.g. [using PowerPoint](#))
5. Upload these files in M-Tool under *media, upload media*. (Note: the files to be uploaded should not exceed 100MB, and can take a few moments to upload).

Make sure you select the right type of format for the media file you uploaded, if this is incorrect, you will not be able to use it in the study creation.

The screenshot shows the 'New Media' upload form in the M-Tool interface. The form is titled 'New Media' and includes the following fields and options:

- File:** A file selection button labeled 'Choose a file...'. Below it, a note states: 'Required and the maximum file size allowed is 100 MB. Please make sure that the files can be used in the browser. We recommend .mp4 for videos, .m4a for audio, and .png for images.'
- Name:** A text input field with a 'Required' label below it.
- Note:** A larger text area for notes, labeled 'Optional' below it.
- Type:** Radio buttons for 'Video', 'Audio', and 'Image', with a 'Required' label below them.

At the bottom right of the form, there are two buttons: a red 'Cancel' button and a green 'Upload media' button.



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6. Next, create a study by going to *studies*, and *add new study*.

Study creation

You can create new studies here. Note: Please make sure you have uploaded the media that you want to use before you create a study.

Name Required

Description Optional

Consent Text Optional

Link to external consent page Optional

Welcome message Required

End of study message Required

Survey Optional. Add {USER_ID} to your survey link to include the participant ID in your study, e.g. https://link-to-my-survey.org/?id={USER_ID}

Screens Mapping screen 1 Mapping screen 2 Bar chart screen At least one required

Arrows neutral positive and negative double-headed At least one required

Videos And Audio

Welcome audio

Introduction video mental model practice task

Practice audio

Icon explanation video

Second icon explanation video

Mapping screen 1 audio

Mapping screen 2 audio

Bar chart tutorial video

Bar chart screen audio

Thank you audio

Here, you can add a name and description of your study, add text for informed consent, or add a link to an external consent form. You can specify the welcome and end message the participant views.

To add a link to an external survey that the participants completes after completing the M-Tool tasks. You can match the participant ID between the M-Tool data and the survey data by adding “?id={USER_ID}” to the survey link. This may work differently depending on your survey software. For example, for Qualtrics, see instructions on how to embed the user ID [here](#).

You can choose whether you want to include 1 or 2 mapping screens, and whether to include the bar chart task. You can also select the type of arrows that the participant can use.

Choose whether you want 1 or 2 mapping screens, whether to include positive and negative arrows, and whether/where to place the target variable.

Select your media files under the respective headings under *Videos and Audio*



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Mapping Screen 1

Fixed icon?

Fixed icon position?

Use?	Image file	Audio explanation (optional)
<input checked="" type="checkbox"/>	<input type="text" value="Default"/>	<input type="text" value="Default"/> <input type="button" value="⊗"/>
<input checked="" type="checkbox"/>	<input type="text" value="Default"/>	<input type="text" value="Default"/> <input type="button" value="⊗"/>
<input checked="" type="checkbox"/>	<input type="text" value="Default"/>	<input type="text" value="Default"/> <input type="button" value="⊗"/>
<input checked="" type="checkbox"/>	<input type="text" value="Default"/>	<input type="text" value="Default"/> <input type="button" value="⊗"/>
<input checked="" type="checkbox"/>	<input type="text" value="Default"/>	<input type="text" value="Default"/> <input type="button" value="⊗"/>

You can set-up the mental model mapping task by indicating if you would like to include a fixe, or target icon, and if so, where you would like to position this icon.

Next, add the system variables that the participant will use, including the image and audio explanation files. Click add icon to include as many variables as you like. Click on the cross to remove a variable.

Bar Chart

Please be aware that the size of the icon adapts to the number of increments. That is, many increments will result in very small icons in the bar chart.

Icon

Title

X-Axis Title

X-Axis Start

X-Axis End

X-Axis Increment

Y-Axis Title

Y-Axis Start

Y-Axis End

Here you can select the icon that will be used by the participant to create the bars. Include a title for the graph, x-axis and y-axis, and define the start and end value of the axes.

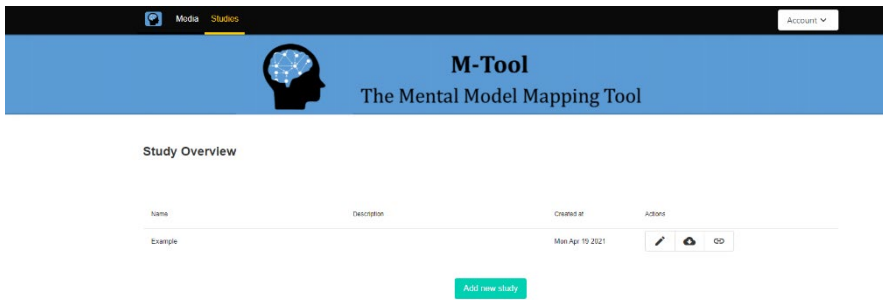
Define the increment of the x-axis, meaning the steps with which the bars will be created by the participants (for example, the x-axis starts at 2010 and ends at 2020, with increments of 1 year, so the participant creates bars for 10 values).

Click create study, and your study will be listed in the study overview.



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In the study overview, you can modify your study, download the data, or access the link to the study that can be shared with participants.

Data safety

The data generated with M-Tool can be downloaded by the account holder only. The data is stored safely on the Heidelberg University server. No third parties (neither the creators) have access to this data.

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References

van den Broek, K.L. (2018). [Illuminating divergence in perceptions in natural resource management: A case for the investigation of the heterogeneity in mental models.](#) *Journal of Dynamic Decision Making*, 4, 2-2.

van den Broek, K.L., Luomba, J., van den Broek, J. & Fischer, H. (forthcoming). Introducing and Validating the Mental Model Mapping Tool.

Contact



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For more information on M-Tool, go to www.m-tool.org

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